TELEMETRY, TRACKING, AND COMMAND CONSOLIDATION IN NASA's DEEP SPACE NETWORK

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ABSTRACT

The Deep Space Mission System at JPL provides tracking, telemetry and command (TT&C) services for a broad spectrum of deep space missions. The TT&C equipment in the Deep Space Network (DSN) is undergoing extensive upgrades and advanced development that will result in more robust systems and standardized customer interfaces for data access and reciprocal support. As part of the upgrade task, known as the Network Simplification Project (NSP), the TT&C architecture and implementation was re-examined. Currently, the TT&C functions are handled in six different subsystems, each with independent controllers whose design does not consider the interaction required between the functions. The NSP project is modernizing the telemetry and command equipment, redesigning the ranging processing and tracking data formats, and consolidating the control of the major elements of the uplink and downlink components.

The new equipment improves reliability and simplifies maintenance by using commercial components, as opposed to the custom built equipment it is replacing. The simplified control architecture consolidates the functions that are interdependent, centralizing the control and reducing the operational unit to a level that does not waste valuable resources. The new ranging architecture enables the ranging and doppler functions to be simply incorporated into the new uplink and downlink equipment and generates a new, expandable tracking data format that avoids the inflexible bit-packed approach in the current products. The new uplink command equipment includes the new CCSDS-standardized Space Link Extension (SLE) service interface, enabling cross-support with other agencies. This paper describes the new architecture, implementation, and lessons learned in the DSN Network Simplification Project.